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Syllabus 2023-24
Panjab University

BA/BSc
(MATHS)

SIXTH SEMESTER

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MATHEMATICS
SEMESTER VI

Paper I : ANALYSIS - II

Max. Marks : 30
Time : 3 hrs.

Note:
1. The syllabus has been split into two Units: Unit-I and Unit-II. Four questions will be set from each Unit.
2. A student will be asked to attempt five questions selecting at least two questions from each Unit. Each question will carry 6 marks.
3. The teaching time shall be five periods (45 minutes each) per paper per week including tutorial.
4. If internal assessment is to be conducted in the form of written examinations, then there will be only one written examination in a Semester.

Unit-I

Double and triple integrals : Double Integral over A Rectangle, Repeated Integrals in $\mathbf{R}^2$, Double Integrals over Bounded Non-rectangular Regions, Area of Bounded Regions in Plane, Double Integrals as Volumes, Change of Variables in Double Integrals, Change to Polar Coordinates, Area in Polar Coordinates, Triple Integral in Rectangular Coordinates, Triple Integrals over General Regions in $\mathbf{R}^3$, Repeated Integrals in $\mathbf{R}^3$, Volume of a Region in $\mathbf{R}^3$, Change of Variables in a Triple Integral to Cylindrical and Spherical Coordinates
Vector Integration : Line, Surface and Volume integration. Gauss divergence theorem, Stokes' theorem, Green's theorem.

Unit-II

Sequences and series of functions : Pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and Riemann integration, uniform convergence and differentiation, Weierstrass approximation theorem(Statement only), Abel's and Taylor's theorems for power series.

Fourier series : Fourier expansion of piecewise monotonic functions, Fourier Series for Odd and Even Function, Half Range Series, Fourier Series in the Intervals $[0, 2\pi]$, $[-1, 1]$ and $[a, b]$.

References:

1. T. M. Apostol : Mathematical Analysis, Norosa publishing House, New Delhi, 1985.
2. R. R. Goldberg : Real Analysis, Oxford & IBH Publishing Co., New Delhi, 1970.
3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983.
4. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.

5. P.K.Jain and S.K.Kaushik : An Introduction to Real Analysis, S. Chand & Co., New Delhi, 2000.
6. S.C.Malik and Savita Arora : Mathematical Analysis, 2nd edition, New Age International Publishers.
7. G.B.Thomas and R. L. Finney : Calculus and Analytic Geometry (Ninth edition), Pearson Publication.
8. D. Somasundaram and B. Choudhary : A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.

Paper II : LINEAR ALGEBRA

Max. Marks : 30
Time : 3 hrs.

Note:
1. The syllabus has been split into two Units: Unit-I and Unit-II. Four questions will be set from each Unit.
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3. The teaching time shall be five periods (45 minutes each) per paper per week including tutorial.
4. If internal assessment is to be conducted in the form of written examinations, then there will be only one written examination in a Semester.

Unit-I

Vectror Space : Definition and Examples of Vector Spaces, Subspaces, Algebra of subspaces, Linear span, Linear dependence and independence of vectors, Basis and dimension of a vector space, Basis and dimension of subspace, Direct sums and complements

Linear transformations, Rank and Nullity of a linear transformation, Vector space of linear transformations

Unit-II

Linear transformations and matrices, Change of basis.

Characteristic roots and characteristic vectors, Algebraic and Geometric multiplicity of a characteristic value, Cayley-Hamilton theorem, Diagonalizable operators and matrices. Minimal polynomial of a linear operator (matrix).

References :

1. K. Hoffman and R. Kunze : *Linear Algebra*, 2nd Edition, Prentice Hall, New Jersy, 1971.
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, First Course in Linear Algebra (Wiley Eastern Delhi).
3. J. Gilbert and L. Gilbert: Linear Algebra and Matrix Theory (Academic Press).
4. I.N. Herstein, Topics in Algebra (Delhi Vikas).
5. V.Bist and V. Sahai, Linear Algebra (Narosa, Delhi).

Paper III : NUMERICAL ANALYSIS

Max. Marks : 30
Time : 3 hrs.

Note:
1. The syllabus has been split into two Units: Unit-I and Unit-II. Four questions will be set from each Unit.
2. A student will be asked to attempt five questions selecting at least two questions from each Unit. Each question will carry 6 marks.
3. The teaching time shall be five periods (45 minutes each) per paper per week including tutorial.
4. If internal assessment is to be conducted in the form of written examinations, then there will be only one written examination in a Semester.

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SECTION A

Solution of Equations: Bisection, Secant, Regula Falsi, Newton's Method, Roots of Polynomials.
Interpolation: Lagrange and Hermite Interpolation, Divided Differences, Difference Schemes, Interpolation

Formulas using Difference.

Numerical Differentiation.
Numerical Quadrature: Newton-Cote's Formulas, Gauss Quadrature Formulas, Chebychev's Formulas.

SECTION B

Linear Equations: Direct Methods for Solving Systems of Linear Equations (Gauss Elimination, LU Decomposition, Cholesky Decomposition), Iterative Methods (Jacobi, Gauss-Seidel, Relaxation Methods).
The Algebraic Eigenvalue problem: Jacobi's Method, Givens' Method, Householder's Method, Power Method, QR Method, Lanczos' Method.
Ordinary Differential Equations: Euler Method, Single-step Methods, Runge-Kutta's Method, Multi-step Methods.

References

1. C.E. Froberg : *Introduction to Numerical Analysis* (Second Edition),Addison-Wesley, 1979.
2. Melvin J. Maron : *Numerical Analysis : A Practical Approach,* Macmillan Publishing Co., New York, 1982.
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain : *Numerical Methods for Scientific and Engineering Computation,* New Age International (P.) Ltd., 1999.
4. R.Y. Rubistein : *Simulation and the Monte Carlo Methods,* John Wiley, 1981.
5. D. J. Yakowitz : *Computational Probability and Simulation,* Addison-Wesley, 1977.
6. S.S. Sastry : *Introductory Methods of Numerical Analysis,* 3rd Edition (2000), Prentice Hall of India Pvt. Ltd., New Delhi.
